ATENT COOPERATION TI ,TY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 11 November 1999 (11.11.99)	
International application No. PCT/IB99/00267	**Applicant's or agent's file reference**
International filing date (day/month/year) 15 February 1999 (15.02.99)	**Priority date** (day/month/year) 20 February 1998 (20.02.98)
Applicant RAKHIMOV, Rustam	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

14 September 1999 (14.09.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Juan Cruz
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

To achieve the set objective, in Claim 1 of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same*, which involves treating materials and articles with IR radiation generated by a ceramic material capable of absorbing energy and emitting IR radiation, the materials and articles are simultaneously treated with pulse IR radiation generated by one ceramic material at a wavelength of 16.0-16.25 micron, at which the water contained in the microorganisms vaporises, and IR radiation generated by another ceramic material at a wavelength of 8.2-10.0 micron, which corresponds to the maximum of absorption of IR radiation by organic matter, with the IR radiation from both ceramic materials being directed uniformly on all sides at the materials and articles to be sterilized.

To achieve the set objective, in Claim 2 of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same*, the device for sterilizing materials and articles consists of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing energy and emitting IR radiation at one or more selective wavelengths, a second ceramic material capable of absorbing energy and emitting IR radiation at one or more selective wavelengths, with the radiation from the second ceramic material being different from that from the first ceramic material and directed at the materials and articles to be sterilized.

The first ceramic material is a compound on the basis of lanthanum and contains the following ingredients, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

CLAIMS

1. A method for sterilizing materials and articles by exposing the materials and articles to IR radiation generated by a ceramic material capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, whose distinguishing feature is that the materials and articles are simultaneously exposed to pulse IR radiation generated by one ceramic material, with a wavelength in a range of 16.0 - 16.25 micron, at which the water contained in microorganisms vaporizes, and to IR radiation generated by another ceramic material, with a wavelength in a range of 8.2 – 10.0 micron, at which organic matter has maximal absorption of IR radiation, and the said IR radiation from both the first and the second ceramic material being directed uniformly on all sides at the materials and articles to be sterilized.

2. A device for sterilizing materials and articles, consisting of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, a second ceramic material capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, with the radiation generated by the second ceramic material being different from that by the first ceramic material and directed at the materials and articles to be sterilized, whose distinguishing feature is that the first ceramic material is a compound on the basis of lanthanum and contains the following ingredients, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

the second ceramic material is a compound on the basis of iron oxide and contains the following ingredients, wt%:

Chromium oxide	28.0 - 32.0
Calcium carbonate	7.0 - 10.0
Iron oxide	33.0 - 35.0
Silicon dioxide	16.0 - 17.5
Magnesium oxide	4.0 - 6.0
Calcium oxide	2.5 - 3.5
Aluminium oxide	1.5 - 2.0
Copper (II) oxide	0.5 - 1.0

with the ceramic material situated around the means for generating energy and making it possible to produce IR radiation directed at the materials and articles to be sterilized simultaneously from each ceramic material, and the device additionally has an external chamber, with the chamber for holding materials and articles being installed in the external chamber with a gap between the two, the external chamber is equipped with a fan capable of blowing the external surface of the chamber for holding materials and articles, and each energized element surrounded by the ceramic materials is equipped with a reflecting system which, together with the reflecting systems of the other energized elements, forms the internal surface of the chamber for holding materials and articles, and the number of energized elements, their arrangement and the shape of the reflective surface of each element have been chosen such that the most radiation can be uniformly directed into the region of the fixture for supporting materials and articles, and the internal surface of the chamber for holding materials and articles is made of a material that has high reflectance.

3. A device according to Claim 2, whose distinguishing feature is that the energized element contains at least one halogen lamp or one high-resistance coil within a glass tube.

4. A device according to Claim 2, whose distinguishing feature is that the ceramic materials are painted onto the surface of the halogen lamp or glass tube.

5. A device according to Claim 2, whose distinguishing feature is that the means for generating energy consists of three energized elements, with one element situated at the bottom, and the other two at the top of the chamber for holding materials and articles.

6. A device according to Claims 2 and 5, whose distinguishing feature is that the chamber for holding materials and articles is made in the form of three trapezoid reflectors joined together.

7. A device according to Claim 2, whose distinguishing feature is that the fixture for supporting materials and articles to be sterilized is made in the form of a wire tray connected to the door and capable of being moved out of the chamber.

PATENT COOPERATION TREATY

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2/8 504

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/IB 99/00267	15/02/1999	20/02/1998
Applicant		
RAKHIMOV, Rustam		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

[ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

[ ] contained in the international application in written form.

[ ] filed together with the international application in computer readable form.

[ ] furnished subsequently to this Authority in written form.

[ ] furnished subsequently to this Authority in computer readble form.

[ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

[ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

[X] the text is approved as submitted by the applicant.

[ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

[ ] the text is approved as submitted by the applicant.

[X] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

[ ] as suggested by the applicant.

[ ] because the applicant failed to suggest a figure.

[ ] because this figure better characterizes the invention.

[X] None of the figures.

EK 473444496 US

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 99/00267

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

DELETE ALL TEXT FROM LINE 19 AFTER "ELEMENTS."

INTERNATIONAL SEARCH REPORT

International Application No
IB 99/00267

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61L2/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 350 927 A (KIM ELENA V ET AL) 27 September 1994 (1994-09-27) column 3, line 45 - line 50 claims 1,8,10,19-23	1-7

☐ Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 July 1999	22/07/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Heck, G

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IB 99/00267

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5350927 A	27-09-1994	AU 4639693 A	04-01-1994
		CA 2138407 A	23-12-1993
		CN 1083455 A	09-03-1994
		EP 0700572 A	13-03-1996
		MX 9303608 A	01-12-1993
		WO 9326011 A	23-12-1993
		US 5707911 A	13-01-1998
		US 5472720 A	05-12-1995

PATENT COOPERATION TREATY

received on 02.06.2000

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

KHVAN, Antonina
P.O. Box 1526
700115 Tashkent 115
OUZBEKISTAN

18 AUG 2000

IBS

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NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Applicant's or agent's file reference AK-49	Date of mailing *(day/month/year)* 25.05.00
	IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IB99/00267	15/02/1999	20/02/1998

Applicant
RAKHIMOV, Rustam

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Fuerbass, C Tel.+49 89 2399-8132 EK473444496DS

PATENT COOPERATION TREATY

PCT

REC'D 29 MAY 2000

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
AK-49		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/IB99/00267	15/02/1999	20/02/1998
International Patent Classification (IPC) or national classification and IPC A61L2/08		
Applicant RAKHIMOV, Rustam		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
14/09/1999	25. 05. 00
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Tragoustis, M Telephone No. +49 89 2399 8623

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/IB99/00267

I. Basis of th r port

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-6,8-17	as originally filed			
7	as received on	22/02/2000	with letter of	18/02/2000

Claims, No.:

1-7	as received on	22/02/2000	with letter of	18/02/2000

Drawings, sheets:

1/3-3/3	as originally filed

2. The amendments have resulted in the cancellation of:

☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims 1-7
	No:	Claims
Inventive step (IS)	Yes:	Claims 1-7
	No:	Claims
Industrial applicability (IA)	Yes:	Claims 1-7
	No:	Claims

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

1. The application relates to a method (see claim 1) and to a device (see claim 2) for sterilizing materials and articles by exposing the materials and articles to two different IR radiations of different wavelengths generated by two ceramic materials.
   By means of the claimed combination of different IR radiations emitted from the two different ceramic materials efficient killing of microbes, viruses and bacteria and efficient sterilization under low temperature is obtained.
   The cited document US-A-5350927 discloses the sterilization of medical articles by means of two ceramic materials emitting different IR radiations. This document however is silent about the specific wave lengths defined in claims 1 and 2, and about a specific wave length radiation being a pulsed radiation. Moreover the specific compositions of the ceramic compounds and the constructional details of the device relating to the arrangement of the two chambers and the fan defined in claim 2 cannot be found in this document.
   In the absence of any information relating to these features claimed in claims 1 and 2 an inventive step must be acknowledged.
   Hence claims 1, 2 and the dependent claims 3-7 meet the requirements of Art. 33 PCT.

2. The use of the term "prototype" in the description (see e.g. page 2, line 17; page 6, line 3) is not clear and does not correspond to usual meaning of the word prototype.

To achieve the set objective, in Claim 1 of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same*, which involves treating materials and articles with IR radiation generated by a ceramic material capable of absorbing energy and emitting IR radiation, the materials and articles are simultaneously treated with IR radiation generated by the first ceramic material at a wavelength of 8.2-10.0 micrometres, which corresponds to the maximum of absorption of IR radiation by organic matter, and pulse IR radiation generated by the second ceramic material at a wavelength of 16.0-16.25 micrometres, at which the water contained in the microorganisms vaporises, and the IR radiation from both ceramic materials being directed uniformly on all sides at the materials and articles to be sterilized.

To achieve the set objective, in Claim 2 of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same*, the device for sterilizing materials and articles consists of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing energy and emitting IR radiation at one or more selective wavelengths, a second ceramic material capable of absorbing energy and emitting IR radiation at one or more selective wavelengths, with the radiation from the second ceramic material being different from that from the first ceramic material and directed at the materials and articles to be sterilized.

The first ceramic material is a compound on the basis of lanthanum and contains the following ingredients, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

CLAIMS

1. A method for sterilizing materials and articles by exposing the materials and articles to IR radiation generated by a ceramic material capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, characterized in that the materials and articles are simultaneously exposed to IR radiation generated by the first ceramic material, with a wavelength in a range of 8.2 – 10.0 micrometres, at which organic matter has maximal absorption of IR radiation, and to pulse IR radiation generated by the second ceramic material, with a wavelength in a range of 16.0 - 16.25 micrometres, at which the water contained in microorganisms vaporizes, and the said IR radiation from both the first and the second ceramic material being directed uniformly on all sides at the materials and articles to be sterilized.

2. A device for sterilizing materials and articles, consisting of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, a second ceramic material capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, with the radiation generated by the second ceramic material being different from that by the first ceramic material and directed at the materials and articles to be sterilized, characterized in that the first ceramic material, capable of emitting IR radiation at a wavelength of 8,2 - 10.0 micrometres, is a compound on the basis of lanthanum and contains the following ingredients, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

the second ceramic material, capable of emitting pulse IR radiation at a wavelength of 16,0 - 16.25 micrometres, is a compound on the basis of iron oxide and contains the following ingredients, wt%:

Chromium oxide	28.0 - 32.0
Calcium carbonate	7.0 - 10.0
Iron oxide	33.0 - 35.0
Silicon dioxide	16.0 - 17.5
Magnesium oxide	4.0 - 6.0
Calcium oxide	2.5 - 3.5
Aluminium oxide	1.5 - 2.0
Copper (II) oxide	0.5 - 1.0

with the ceramic material situated around the means for generating energy and making it possible to produce IR radiation directed at the materials and articles to be sterilized simultaneously from each ceramic material, and the device additionally has an external chamber (1), with the chamber (2) for holding materials and articles being installed in the external chamber (1) with a gap (3) between the two, the external chamber (1) is equipped with a fan (4) capable of blowing the external surface of the chamber (2) for holding materials and articles, and each energized element (5) surrounded by the ceramic materials is equipped with a reflecting system which, together with the reflecting systems of the other energized elements, forms the internal surface of the chamber (2) for holding materials and articles, and the number of energized elements (5), their arrangement and the shape of the reflective surface of each energized element (5) have been chosen such that the most radiation can be uniformly directed into the region of the fixture for supporting materials and articles to be sterilized (11), and the internal surface of the chamber (2) for holding materials and articles is made of a material that has high reflectance.

3. A device according to Claim 2, characterized in that the energized element (5) contains at least one halogen lamp or one high-resistance coil within a glass tube.

4. A device according to Claim 3, characterized in that the ceramic materials are painted onto the surface of the halogen lamp or glass tube.

5. A device according to Claim 2, characterized in that the means for generating energy consists of three energized elements (5), with one element situated at the bottom, and the other two at the top of the chamber (2) for holding materials and articles.

6. A device according to Claims 2 and 5, characterized in that the chamber (2) for holding materials and articles is made in the form of three trapezoid reflectors (10) joined together.

7. A device according to Claim 2, characterized in that the fixture for supporting materials and articles to be sterilized (11) is made in the form of a wire tray connected to the door and capable of being moved out of the chamber.

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WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
A61L 2/08

A1

(11) International Publication Number: WO 99/42141

(43) International Publication Date: 26 August 1999 (26.08.99)

(21) International Application Number: PCT/IB99/00267

(22) International Filing Date: 15 February 1999 (15.02.99)

(30) Priority Data:
IHDP 9800112.1 20 February 1998 (20.02.98) UZ

(71)(72) Applicant and Inventor: RAKHIMOV, Rustam [UZ/UZ]; Ergashev Street, 54, Tashkent, 700084 (UZ).

(74) Agent: KHVAN, Antonina; P.O. Box 1526, Tashkent–115, 700115 (UZ).

(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: METHOD FOR STERILIZING MATERIALS AND ARTICLES AND A DEVICE FOR IMPLEMENTING THE SAME

(57) Abstract

The present invention relates to medicine, more particularly, to methods and devices for sterilizing materials and articles. The invention makes it possible to raise sterilization efficiency by treating the materials and articles to be sterilized simultaneously by pulse IR radiation with a wavelength in a range of 16.0–16.25 micron, at which the water contained in microorganism vaporizes, and IR radiation with a wavelength in a range of 8.2–10.0 micron, at which the absorption of IR radiation by organic matter is maximal, with the IR radiation being directed simultaneously on all sides at the materials and articles to be sterilized. The IR radiation is produced by ceramic materials capable of absorbing energy and emitting IR radiation, with the ceramic materials being situated around a means for generating energy which consists of energized elements.

METHOD FOR STERILIZING MATERIALS AND ARTICLES AND A DEVICE FOR IMPLEMENTING THE SAME

The present invention relates to medicine, more particularly, to methods and devices for sterilizing materials and articles, and can be used for sterilizing syringes, scarifiers, scalpels, steel drills and other medical instruments and materials. It can also be used in the food industry for sterilizing containers and packages, in the service industry (at the hairdresser's and barber's), in eating houses for sterilizing tableware, covers, etc., and in the pharmaceutical industry for sterilizing bottles and other containers.

A method for sterilizing articles is known set out in Uzbekistan Patent # 1312, published 30.12.1994.

The method for sterilizing articles, preferably medical instruments, consists in exposing them to pulses of infrared (IR) radiation; in this method IR radiation is generated by a screen coated with a converting layer and the wavelength of the radiation is chosen in a range where water has a maximal absorption coefficient, and the articles are at the same time as receiving pulse IR radiation exposed to continuous IR radiation which is generated at wavelengths $\geq$ (equal or exceeding) 3 micron, so as to raise the temperature inside the sterilizer and reduce the warm-up time (the time the sterilizer takes to reach the operating conditions).

Identical to the essential features of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same* as set out in Claim 1 are the following: things are exposed to pulse IR radiation while being simultaneously subjected to continuous IR radiation with the wavelength lying in another range.

One shortcoming of this method is that it is insufficiently effective in that it does not use radiation that is capable of destroying organic compounds. In order to do that, sterilization has to be conducted at rather a high temperature, and the articles being treated get heated to 170-180°C, which has an adverse effect on materials and articles. High temperature can damage them, since they get overheated and consequently lose

their functional properties. The screen coated with the converting layer, whose function is to generate IR radiation, begins operating only on reaching the activation temperature, i.e. the screen has to be warmed up and the operating conditions are attained, according to the examples given in this patent, during 5 to 7 minutes, which means that the screen has considerable thermal lag.

Besides, after sterilization is completed, even if it takes only 1 minute, it is necessary to cool down the sterilized articles (heated to 170-180°C) which, obviously, remain in the sterilizer and will cool down during a certain time which, in view of sterilizer thermal lag, will be 15 to 20 minutes at the very least. Furthermore, the screen coated with the converting layer which generates IR radiation does not ensure the uniformity of irradiating the articles being treated, since effective sterilization requires that IR radiation should fall on the articles on all sides simultaneously, and the radiation generated by the screen falls only within a certain solid angle.

An invention is known set out in US Patent # 5,350,927, *Radiation Emitting Ceramic Materials and Devices Containing Same*, which is taken as the prototype.

The patent discloses a method for sterilizing medical instruments and a device for sterilization.

The method for sterilization consists in exposing medical instruments to IR radiation generated by a ceramic material that is capable of absorbing energy and emitting IR radiation at one or more selective wavelengths at which the IR radiation from the first ceramic material is absorbed by a second ceramic material and the radiation from the second is directed at the articles (medical instruments) in order to sterilize them.

This patent describes a sterilizing device, which consists of: a chamber for holding materials and articles to be sterilized, a means for generating energy in the chamber, a first ceramic material made of a composition based on a rare-earth chromium oxide and a stabilizing composition containing sufficient amounts of an alkaline-earth metal spinel

and an alkaline-earth metal chromate together stabilizing the composition based on the rare-earth chromium oxide, which is placed inside the chamber to absorb energy from the means for generating it and to emit IR radiation at one or more selective wavelengths, which radiation is directed at the articles in order to sterilize them.

In this device the means for generating energy contains an energized element, which is brought in such contact with the first ceramic material that a substantial portion of the energy generated by the element is absorbed by the first ceramic material. When the first ceramic material is positioned adjacent to at least part of the energized element a substantial portion of the energy produced by the means for its generation is absorbed by the first ceramic material. The first ceramic material can be made in the form of a concentric tube around at least one of the elements and, if necessary, around each element, and the device can contain fixtures to support articles to be sterilized. To optimize operation the device additionally contains a second ceramic material placed inside the chamber to emit IR radiation with one or more wavelengths, which radiation can be either the same as emitted by the first ceramic material or different from it. This radiation is directed at the articles in order to sterilize them. The second ceramic material is placed inside the chamber to absorb the IR radiation from the first ceramic material and positioned near at least part of the first ceramic material so that a substantial portion of the IR radiation emitted by the first ceramic material is absorbed by the second ceramic material. The second ceramic material must be positioned adjacent to a substantial portion of the first ceramic material, e.g., in the form of a concentric tube around the first ceramic material. The second ceramic material can also be made in the form of a plate positioned adjacent to the energized element to absorb a substantial portion of the IR radiation emitted by the first ceramic material.

The first ceramic material is made from a rare-earth chromium oxide and a stabilizing composition containing sufficient amounts of an alkaline-earth metal spinel and an alkaline-earth metal chromate.

The second ceramic material contains:

Chromium oxide	Cr_2O_3	13.5 - 51.5%
Silicon dioxide	SiO_2	10.0 - 28.0%
Iron oxide	Fe_2O_3	15.0 – 35.0%
Calcium oxide	CaO	up to 15.0%
Aluminium oxide	Al_2O_3	up to 3.5%
Magnesium oxide	MgO	up to 3.0%
Copper (II) oxide	CuO	up to 2.0%

Identical to the essential features of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same* as set out in Claim 1 are the following: the articles are exposed to IR radiation generated by a ceramic material that is capable of absorbing energy and emitting IR radiation at one or more selective wavelengths.

One shortcoming of the above method is that it is insufficiently effective, since by this method articles are not exposed to IR radiation that is capable of destroying organic compounds. To destroy organic compounds sterilization has to be carried out at rather a high temperature, and the articles get heated to 170-180°C, which has an adverse effect on the materials and articles to be treated, since high temperature can damage them.

Besides, this method does not ensure uniform exposure of the articles, yet effective sterilization requires that IR radiation should fall on the articles on all sides simultaneously.

Identical to the essential features of the proposed invention as set out in Claim 2 are the following: a device for sterilizing articles consists of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber consisting of at least one energized element, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing the energy and emitting IR radiation at one or more selective wavelengths, a second ceramic

material capable of absorbing the energy and emitting IR radiation at one or more selective wavelengths and the radiation from the second ceramic material being different from the radiation emitted by the first ceramic material and directed at the materials and articles to be sterilized.

One shortcoming of the above device is its insufficient effectiveness, since this device sterilizes things only with radiation generated by the second ceramic material and does not use IR radiation that is capable of destroying organic compounds. Actual working models of the sterilizer according to US Patent # 5,350,927 do not provide the degree of sterilization given in the description, 125°C. This device ensures sterilization only when the articles are heated to 170-180°C. In order to destroy organic compounds sterilization has to be conducted at rather a high temperature, the articles are heated to 170-180°C, which has an adverse effect on the materials and articles to be treated, since they lose their functional properties as a result of overheating. Also, after sterilization is completed, even if it takes only 1 minute, it is necessary to cool off the articles heated to 170-180°C, which, obviously, have to remain inside the sterilizer until they cool off completely, i.e. they will be affected by high temperature not for 1, 2 or 3 minutes, but for a much longer period, up to 15 and more minutes. Furthermore, the radiation directed at the articles to sterilize them from the second ceramic material made in the form of a concentric tube around the first ceramic material or in the form of a plate positioned adjacent to the energized element does not ensure uniform irradiation of the articles being treated, since effective sterilization requires that the articles be exposed to IR radiation on all sides simultaneously.

The proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same* as set out in Claims 1 and 2 is intended to raise sterilization effectiveness by exposing materials and articles to be sterilized to IR radiation whose wavelength ensures maximal sterilization without overheating the materials and articles, and by exposing materials and articles to be sterilized to uniform IR radiation which falls on the materials and articles on all sides simultaneously.

The principle of sterilization by the ceramic emitter rests on the fact that all bacteria, viruses and other microbes contain water. An IR ceramic, called the second ceramic material in the prototype, absorbs radiation from a first ceramic material, converts it and produces a short pulse at a wavelength of 16.0-16.25 micron with a high density, that is attuned to water molecules (H_2O). This pulse is absorbed by the water contained in microorganisms, and the water, turning to vapor, bursts the cell from inside, which results in killing all microbes: viruses, bacteria, fungi, as well as their spores.

Sterilizing materials and articles is done using pulse IR radiation generated by a ceramic material at a wavelength of 16.0-16.25 micron. In this range water has maximal absorption. At this wavelength organic matter becomes `transparent', that is, it does not absorb energy, and water becomes `black', that is, it has maximal absorption. Therefore the water molecules, under the influence of radiation with specified properties, evaporate, carrying away the excessive heat energy.

However, any organic matter consists of water (H_2O) and organic compounds, and their respective absorption spectra are different.

To raise sterilization efficiency, the present invention proposes treating materials and articles simultaneously, while exposed to pulse radiation at a wavelength of 16.0-16.25 micron, by other IR radiation whose wavelength falls within a range of 8.2-10.0 micron, generated by another ceramic material. This range of 8.2-10.0 micron corresponds to maximal absorption by organic matter.

All microbes reproduce by division. This process consists of strictly ordered biochemical pathways by which the number of microorganisms, including pathogenic ones, increases. By influencing the above pathways at a certain point by IR radiation in a range of 8.2-10.0 micron the processes of division and reproduction are brought to a halt. The microorganisms, unable to divide any longer, die, since their life-cycle is extremely short.

To achieve the set objective, in Claim 1 of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same*, which involves treating materials and articles with IR radiation generated by a ceramic material capable of absorbing energy and emitting IR radiation, the materials and articles are simultaneously treated with pulse IR radiation generated by one ceramic material at a wavelength of 16.0-16.25 micron, at which the water contained in the microorganisms vaporises, and IR radiation generated by another ceramic material at a wavelength of 8.2-10.0 micron, which corresponds to the maximum of absorption of IR radiation by organic matter, with the IR radiation from both ceramic materials being directed uniformly on all sides at the materials and articles to be sterilized.

To achieve the set objective, in Claim 2 of the proposed invention *Method for Sterilizing Materials and Articles and a Device for Implementing the Same*, the device for sterilizing materials and articles consists of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing energy and emitting IR radiation at one or more selective wavelengths, a second ceramic material capable of absorbing energy and emitting IR radiation at one or more selective wavelengths, with the radiation from the second ceramic material being different from that from the first ceramic material and directed at the materials and articles to be sterilized.

The first ceramic material is a compound on the basis of lanthanum and contains the following ingredients, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

The first ceramic material makes it possible to produce IR radiation at a wavelength of 8.2-10.0 micron, which corresponds to the range of maximal absorption by organic matter, since this IR radiation, at a wavelength of 8.2-10.0 micron, destroys organic matter.

The first ceramic material described in the prototype makes it possible to produce IR radiation at a wavelength of 3.0 – 7.0 micron, and the properties of the first ceramic material according to the prototype differ from those of the first ceramic material according to the proposed invention. Besides, in the prototype the first ceramic material functions as a source of IR radiation to be absorbed by the second ceramic material, i.e., the IR radiation from the first ceramic material is not intended to sterilize materials and articles.

The second ceramic material is a compound on the basis of iron and contains the following ingredients, wt%:

Chromium oxide	28.0 - 32.0
Calcium carbonate	7.0 - 10.0
Iron oxide	33.0 - 35.0
Silicon dioxide	16.0 - 17.5
Magnesium oxide	4.0 - 6.0
Calcium oxide	2.5 - 3.5

The second ceramic material makes it possible to produce pulse IR radiation at a wavelength of 16.0-16.25 micron, which makes the water contained in microorganisms vaporize and burst the cell from inside, killing the microbes, viruses and bacteria.

The first and second ceramic materials are situated around the means for generating energy so as to make it possible to produce IR radiation directed at the materials and articles to be sterilized, simultaneously from each ceramic material.

Thus, simultaneously treating materials and articles to be sterilized with IR radiation at a wavelength of 8.2-10.0 micron capable of destroying organic compounds and pulse IR radiation in a range of 16.0-16.25 micron which is absorbed by the water contained in the microorganisms, with the water vaporizing and bursting the cell from inside, raises sterilization efficiency, and the sterilization takes place at a lower temperature, which makes it possible to produce sterilized materials and articles that are not damaged by overheating.

The device additionally contains an external chamber, and the chamber for holding materials and articles is placed in the external chamber with a gap, and the external chamber has a fan installed to blow the external surface of the chamber for holding materials and articles. Such a design makes it possible to lower the temperature inside the chamber for holding materials and articles and prevent their overheating.

Each energized element with the ceramic materials around it is provided with a reflecting system which, together with the reflector systems of the other energized elements, forms the internal surface of the chamber for holding materials and articles, with the number of energized elements, their arrangement and the shape of the reflective surface of each element being chosen so as to direct the most radiation in a uniform manner into the region of the fixture for supporting materials and articles, and the internal surface of the chamber for holding materials and articles being made of a material having high reflectance.

This design of the device makes for the uniformity of irradiating materials and articles to be sterilized: the IR radiation, falling on the internal surface of the chamber for holding materials and articles, which has high reflectance, is reflected and ultimately reaches the materials and articles; moreover, the IR radiation falls on the materials and articles on all sides simultaneously, ensuring that IR radiation reaches the parts of the materials and articles most difficult to reach.

The energized element within the device contains at least one halogen lamp or one high-resistance coil within a glass tube.

To optimize the operation of the device and make efficient use of the ceramic materials, the ceramic materials are painted onto the surface of the halogen lamp or glass tube. In particular, in the proposed device the means for generating energy consists of three energized elements, with one element situated at the bottom, and the other two at the top, of the chamber for holding materials and articles, the chamber for holding materials and articles made in the form of three trapezoid (Am. sense) reflectors joined together, and the fixture for supporting materials and articles to be sterilized made in the form of a tray connected to the door and capable of moving out of the chamber.

The method is implemented in the following way: the chamber for holding materials and articles to be sterilized is loaded with materials and/or articles that have been cleaned of debris and washed.

Halogen lamps coated with ceramic materials are used as IR radiation sources. To prepare an IR radiation source, the ceramic materials were first milled to a fine powder and then a glue based on polyvinyl alcohol was added to the powder. The resulting mixture was applied to the surface of a halogen lamp using a brush and dried. The halogen lamp is first coated with a ceramic material capable of absorbing energy and emitting pulse IR radiation at a wavelength of 16.0-16.25 micron and dried, then the dried layer is coated with a ceramic material capable of absorbing energy and emitting IR radiation at a wavelength of 8.2-10.0 micron, with the latter layer being painted in the form of rings or a spiral, so as to ensure simultaneous IR radiation from both ceramic materials.

In this way one can produce sources with the desired properties of IR radiation: pulse IR radiation with a wavelength of 16.0-16.25 micron and IR radiation with a wavelength of 8.2-10.0 micron.

As a ceramic material, capable of emitting IR radiation at a wavelength of 8.2 – 10.0 micron was used a ceramic material of the following composition, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

As a ceramic material capable of emitting pulse IR radiation at a wavelength of 16.0-16.25 micron was used a ceramic material of the following composition, wt%:

Chromium oxide	28.0 - 32.0
Calcium carbonate	7.0 - 10.0
Iron oxide	33.0 - 35.0
Silicon dioxide	16.0 - 17.5
Magnesium oxide	4.0 - 6.0
Calcium oxide	2.5 - 3.5
Aluminium oxide	1.5 - 2.0
Copper (II) oxide	0.5 - 1.0

When voltage is applied to the halogen lamps the ceramic layers begin heating and in 30 seconds reach the operating conditions. Materials and articles to be sterilized are held for a specified time, usually not longer than 15 minutes, in the chamber for holding materials and articles.

In the method described IR radiation from both ceramic materials is directed uniformly on all sides at the materials and articles to be sterilized which is achieved using the device according to Claim 2 of the present invention.

Example 1.

To conduct tests, a steel bar was used measuring 24.5 mm × 67 mm × 72 mm, in whose side a hole was bored measuring 6.5 mm in diameter and 50 mm deep, and a

steel tube with high reflectance, which was made of a material used for making medical instruments, with an outside diameter of 13 mm, an inside diameter of 10.5 mm, and a length of 76 mm. The tube imitated a medical instrument, having a weight corresponding to that of an average medical instrument. The steel bar had a greater weight, in order to test for the sterility of the largest medical instruments subjected to sterilization.

The test was carried out following standard procedure, using special test spores *SPORDEX* by the American company AMSCO which, according to the procedure, are destroyed at a temperature of 160°C for 25 minutes. The *SPORDEX* spores were attached to the test samples using special heat-resistant tape. The tests were done in the sterilizing device according to Claim 2 of the proposed invention. The test samples were put on a wire tray, which was placed in the chamber for sterilizing materials and articles. Three halogen lamps were used as a source of radiation, situated around the medical instruments to be sterilized, with each lamp coated with ceramic materials capable of simultaneously generating IR radiation with a wavelength of 8.2-10.0 micron and pulse IR radiation with a wavelength of 16.0-16.25 micron and each lamp provided with a dedicated reflecting system. Moreover, the IR radiation from each lamp by the reflecting systems was directed at the medical instruments to be sterilized simultaneously and uniformly on all sides. In this case the time of attaining the operating conditions was 30 seconds.

The tests used one bar and two tubes at a time. The arrangement of items was chosen in such a way so as to provide for the worst possible conditions for sterilization.

The first tube was placed at the back across the wire tray. One test spore was put inside the tube, another was below the tube. The second tube was placed in the front of the wire tray along it. With such a position, the IR radiation had the least possibility of getting inside the tube.

One test spore was put inside the second tube, another was below the tube.
Crosswise at the centre of the wire tray was placed the bar, with test spores attached, one by one: to the lower part of the bar, that is, below it, to its upper part, to its four sides, and one spore was put inside the hole at the side of the bar.

In the area of the maximal expected heating was placed a tube with a firmly attached temperature sensor to monitor the temperature of the test items.

The initial temperature of the items was 24°C.

The wire tray containing the items with the test spores attached in the manner described above was put in the chamber for holding materials and articles. The halogen lamps were turned on by pressing the button at the control panel, and the fan was simultaneously turned on. The guaranteed time to attain the operating conditions is 30 seconds. Actually, the operating conditions are attained instantaneously, since the diameter of the halogen lamp is small, only 6 mm, as is its weight, and the rate of heating is very high.

All in all, 25 tests were conducted, with different times of exposure to IR radiation. After testing the samples were used for bacteriological studies following standard procedure. As little exposure time as 5 minutes was sufficient to produce NO GROWTH results (NO GROWTH means complete sterilization). With an exposure time of 10 minutes the same NO GROWTH was obtained, but the temperature of the items rose to 130°C. Further increasing the exposure time did not result in the temperature of the items rising above 130°C. After completion of exposure the fan was left to operate for another 4.5 minutes to cool off the chamber and items.

Thus, the tests conducted have revealed the sterility of items after they were treated in the proposed sterilizing device for 5 minutes. In compiling the user's manual for the device the sterilization time was set at 15 minutes, so as to provide a threefold safety margin to fully ensure sterility.

Example 2.

The wire tray was loaded with various medical instruments—scalpels, scarifiers, pincers, syringes, etc.—that had been cleaned of debris and washed. The instruments had test spores attached, with the latter invariably put in the places most difficult to sterilize, and on the lower part in contact with the tray.

The tests were conducted following standard procedure, using special test spores *SPORDEX* by the American company AMSCO which, according to the procedure, are killed when exposed to a temperature of 160°C for 25 minutes. The *SPORDEX* spores were attached to the instruments using special heat-resistant tape.

The tests were carried out in the device for sterilization according to Claim 2 of the present invention. The instruments to be tested were put on the wire tray, which was then placed in the chamber for sterilizing materials and articles.

Three halogen lamps were used as a source of IR radiation, which were situated around the medical instruments to be sterilized, with each lamp being provided with a dedicated reflecting system to direct the IR radiation at the medical instruments uniformly on all sides. The lamps were coated with layers of ceramic materials making it possible to simultaneously produce IR radiation with a wavelength of 8.2-10.0 micron and pulse IR radiation with a wavelength of 16.0-16.25 micron. In this case the time of attaining the operating conditions was 30 seconds.

All in all 72 tests were conducted, with different times of exposure to IR radiation and different instruments.

After testing the instruments were used for bacteriological studies following standard procedure. With an exposure time of 3 minutes already in most of the tests, with different instruments tested, NO GROWTH results were achieved (NO GROWTH means complete sterilization), and the temperature of the instrument was 80°C. With an exposure time of 5 minutes in all the cases the result was NO GROWTH.

With an exposure time of 10 minutes also the NO GROWTH result was obtained, and the temperature of the instruments rose to 130°C. With further increasing the exposure time the temperature of the instruments did not exceed 130°C.

After the exposure time elapsed the fan was left to operate for another 5 minutes to cool off the chamber and instruments.

Thus, the tests conducted have revealed that treating instruments according to the method described above for 5 minutes makes them sterile.

To fully ensure sterility the sterilization time is set at 15 minutes, which is 3 times exceeds the time with which in all the test cases complete sterilization was achieved.

Figure 1 shows a cross-section of the proposed device for sterilization.

Figure 2 shows the side view;

Figure 3 shows the front view;

Figures 4 and 5 show the technological sequence of coating the halogen lamp with the ceramic materials;

Figure 6 shows the scheme of closing the chamber.

The device for sterilization consists of: external chamber 1, chamber 2 for holding materials and articles, which is installed in external chamber 1 with gap 3, fan 4, which is installed at the back of external chamber 1, so as to make it possible to blow the external surface of chamber 2 for holding materials and articles, a means for generating energy that consists of three energized elements— halogen lamps 5. Tube 6 of halogen lamp 5 is coated with first ceramic material 7 of the following composition, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 – 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest, i.e. 66.0 - 97.4

In its turn, first ceramic material 7 is coated with second ceramic material 8 of the following composition, wt%:

Chromium oxide	28.0 - 32.0
Calcium carbonate	7.0 - 10.0
Iron oxide	33.0 - 35.0
Silicon dioxide	16.0 - 17.5
Magnesium oxide	4.0 - 6.0
Calcium oxide	2.5 - 3.5
Aluminium oxide	1.5 - 2.0
Copper (II) oxide	0.5 - 1.0

Second ceramic material 8 is painted on top of first ceramic material 7 in the form of rings in such a way that the surface of halogen lamp 5, from which the IR radiation is emitted, is coated with alternating rings of the first and second ceramic materials.

Each halogen lamp 5 is provided with reflecting system 9, made in the form of trapezoid reflector 10. Three trapezoid reflectors 10, each situated around its halogen lamp 5, are joined together and form chamber 2 for holding materials and articles. The trapezoid reflectors 10 are made of aluminium, a material with high reflectance, which makes it possible to attain the maximal reflection of the IR radiation.

Halogen lamps 5 are situated: two at the top, one at the bottom of chamber 2. Situated at the centre of chamber 2 for holding materials and articles is the fixture for supporting materials and articles—wire tray 11. Wire tray 11 is connected to door 12 of external chamber 1. Wire tray 11 is mounted on telescopic rails 13 installed in cabinet 14, which is rigidly joined to chamber 2 for holding materials and articles. Telescopic rails 13 are provided with safety device 15, which tightly closes opening 16 in front wall 17 of chamber 2 for holding materials and articles. The distance between safety device 15 and door 12 exceeds that between front wall 17 of chamber 2 for holding materials and articles and front wall 18 of external chamber 1. Front wall 18 of external chamber 1 contains control panel 19 of the device for sterilizing materials and articles.

The device for sterilizing materials and articles operates in the following manner.

By operating the buttons on control panel 19 the sterilizer is turned on, that is, voltage is applied to halogen lamps 5 coated with first ceramic material 7 and second ceramic material 8; simultaneously, fan 4 is turned on, which blows chamber 2 for holding materials and articles, thereby cooling it. In 30 seconds halogen lamps 5 attain the operating conditions and begin emitting IR radiation simultaneously from both the first and the second ceramic materials. By pulling out door 12 tray 11 is simultaneously pulled out. The articles to be sterilized that have been cleaned of debris and washed in water are loaded on wire tray 11, door 12 is closed until safety device 15 tightly seals opening 16 in the front wall of chamber 2 for holding materials and articles.

After that, there is a gap left between front wall 18 of external chamber 1 and door 12 to ensure that the air blown by fan 4 after cooling chamber 2 for holding materials and articles can go out.

The articles placed on tray 11 are exposed to IR radiation from first ceramic material 7, whose wavelength is in a range of 8.2-10.0 micron, and pulse IR radiation from second ceramic material 8, whose wavelength is 16.0-16.25 micron. The IR radiation from halogen lamps 5 coated with ceramic materials 7 and 8 propagates in different directions. To concentrate the IR radiation and raise the efficiency and uniformity of treating the materials and articles to be sterilized, around halogen lamps 5 are installed trapezoid reflectors 10. The IR radiation, after being reflected from reflectors 10, is directed into the region of tray 11 at the materials and articles to be sterilized.

After exposing the materials and articles to the IR radiation for a specified time door 12 is pulled out and the sterilized materials and articles are taken from tray 11.

CLAIMS

1. A method for sterilizing materials and articles by exposing the materials and articles to IR radiation generated by a ceramic material capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, whose distinguishing feature is that the materials and articles are simultaneously exposed to pulse IR radiation generated by one ceramic material, with a wavelength in a range of 16.0 - 16.25 micron, at which the water contained in microorganisms vaporizes, and to IR radiation generated by another ceramic material, with a wavelength in a range of 8.2 – 10.0 micron, at which organic matter has maximal absorption of IR radiation, and the said IR radiation from both the first and the second ceramic material being directed uniformly on all sides at the materials and articles to be sterilized.

2. A device for sterilizing materials and articles, consisting of a chamber for holding materials and articles to be sterilized, a means for generating energy inside the chamber, a fixture for supporting materials and articles to be sterilized, a first ceramic material situated around the means for generating energy inside the chamber and capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, a second ceramic material capable of absorbing energy and emitting IR radiation with one or more selective wavelengths, with the radiation generated by the second ceramic material being different from that by the first ceramic material and directed at the materials and articles to be sterilized, whose distinguishing feature is that the first ceramic material is a compound on the basis of lanthanum and contains the following ingredients, wt%:

Lanthanum aluminate	0.5 - 10.0
Yttrium chromite	0.5 - 3.0
Magnesium chromite	1.0 - 15.0
Cerium dioxide	0.1 - 1.0
Zirconium dioxide	0.5 - 5.0
Lanthanum chromite	the rest. i.e. 66.0 - 97.4

the second ceramic material is a compound on the basis of iron oxide and contains the following ingredients, wt%:

Chromium oxide	28.0 - 32.0
Calcium carbonate	7.0 - 10.0
Iron oxide	33.0 - 35.0
Silicon dioxide	16.0 - 17.5
Magnesium oxide	4.0 - 6.0
Calcium oxide	2.5 - 3.5
Aluminium oxide	1.5 - 2.0
Copper (II) oxide	0.5 - 1.0

with the ceramic material situated around the means for generating energy and making it possible to produce IR radiation directed at the materials and articles to be sterilized simultaneously from each ceramic material, and the device additionally has an external chamber, with the chamber for holding materials and articles being installed in the external chamber with a gap between the two, the external chamber is equipped with a fan capable of blowing the external surface of the chamber for holding materials and articles, and each energized element surrounded by the ceramic materials is equipped with a reflecting system which, together with the reflecting systems of the other energized elements, forms the internal surface of the chamber for holding materials and articles, and the number of energized elements, their arrangement and the shape of the reflective surface of each element have been chosen such that the most radiation can be uniformly directed into the region of the fixture for supporting materials and articles, and the internal surface of the chamber for holding materials and articles is made of a material that has high reflectance.

3. A device according to Claim 2, whose distinguishing feature is that the energized element contains at least one halogen lamp or one high-resistance coil within a glass tube.

4. A device according to Claim 2, whose distinguishing feature is that the ceramic materials are painted onto the surface of the halogen lamp or glass tube.

5. A device according to Claim 2, whose distinguishing feature is that the means for generating energy consists of three energized elements, with one element situated at the bottom, and the other two at the top of the chamber for holding materials and articles.

6. A device according to Claims 2 and 5, whose distinguishing feature is that the chamber for holding materials and articles is made in the form of three trapezoid reflectors joined together.

7. A device according to Claim 2, whose distinguishing feature is that the fixture for supporting materials and articles to be sterilized is made in the form of a wire tray connected to the door and capable of being moved out of the chamber.

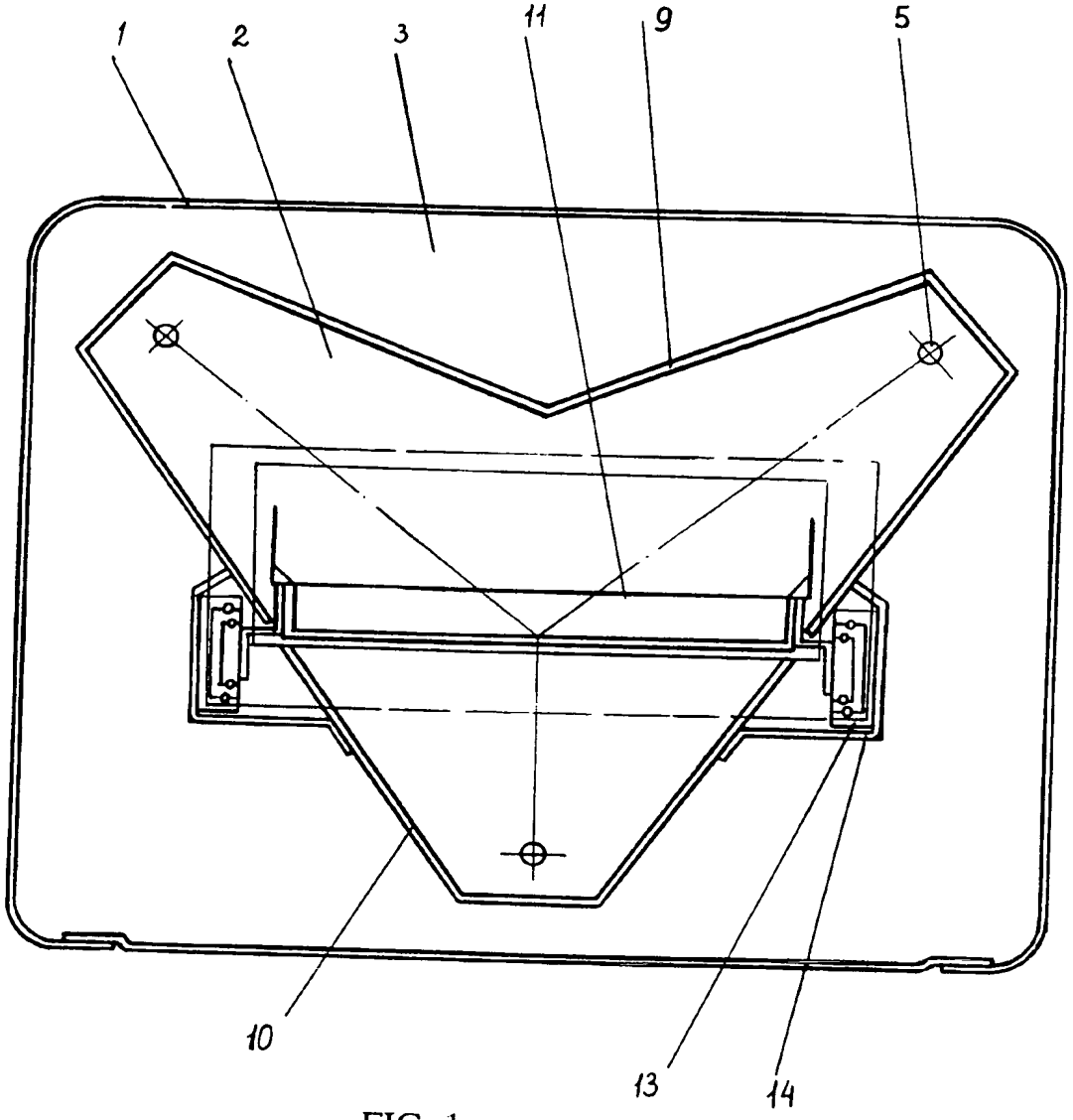

FIG 1

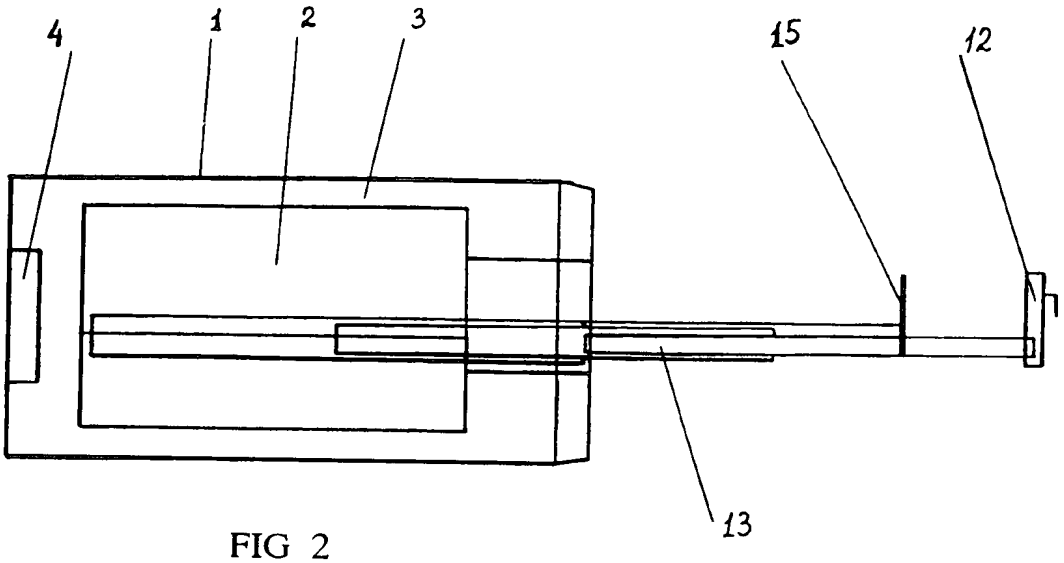

FIG 2

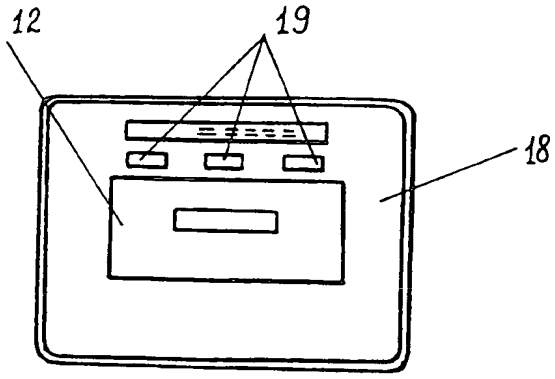

FIG 3

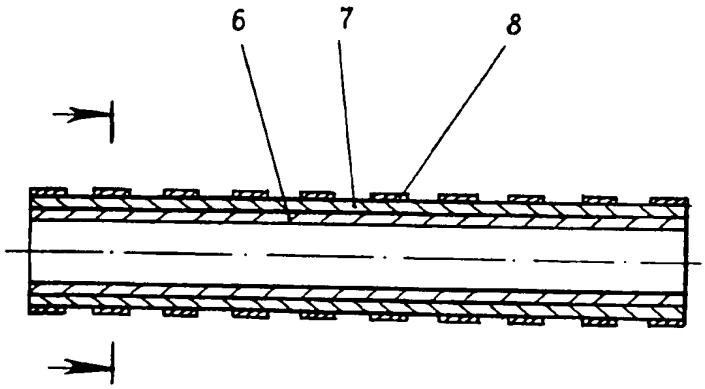

FIG 4

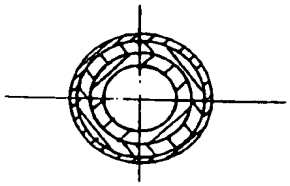

FIG 5

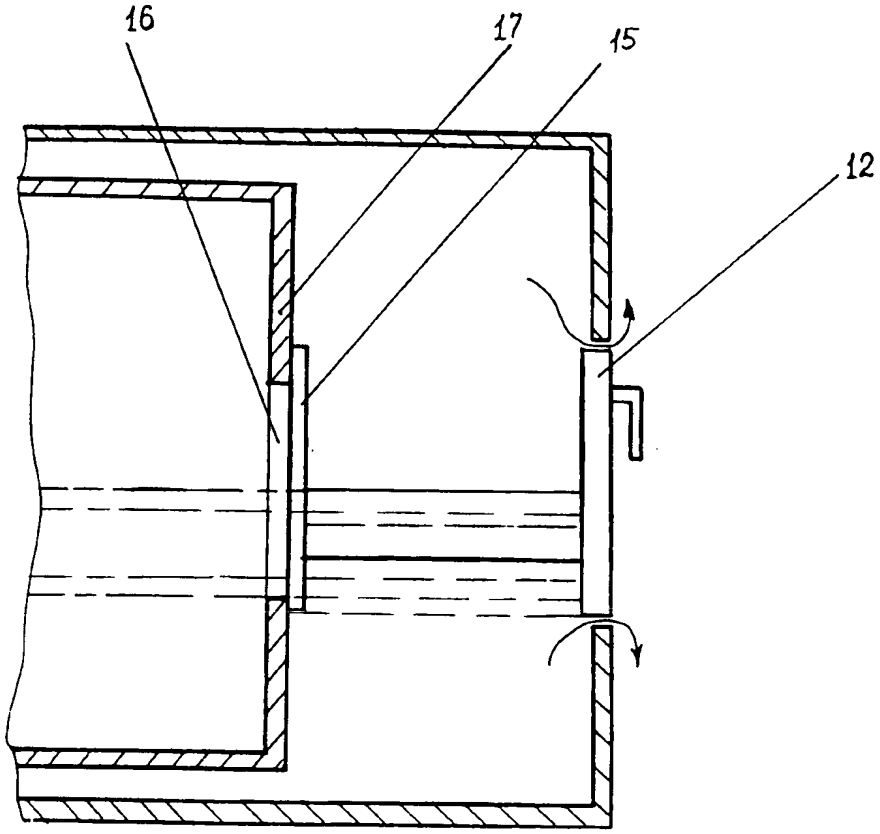

FIG 6

INTERNATIONAL SEARCH REPORT

Int ational Application No
PCT/IB 99/00267

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61L2/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 350 927 A (KIM ELENA V ET AL) 27 September 1994 (1994-09-27) column 3, line 45 - line 50 claims 1,8,10,19-23	1-7

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 July 1999	22/07/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Heck, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IB 99/00267

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		CA 2138407 A	23-12-1993
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		EP 0700572 A	13-03-1996
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